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Making Networks More **Energy Efficient**

Zain is using artificial intelligence (AI) to improve the energy efficiency of its 5G network in Kuwait

Highlights

- The radio access network accounts for 73% of the energy consumed by mobile operators
- Zain Kuwait has deployed Huawei's iPowerStar on 96 5G sites to adjust power consumption in line with traffic changes
- iPowerStar uses AI to enable millisecond-level intelligent power optimisation, real-time resource shutdown, and deep dormancy to reduce network energy consumption.
- Huawei says the sites have improved energy efficiency by 25%, which will avoid around 342 tons of CO_2 emissions per year, without impacting the user experience.
- Power consumption has been further reduced after modernising the sites with new technologies, such as Huawei's Meta AAU (active antenna unit), which is designed to improve bit-per-watt efficiency by 15-20%.

Optimising performance by service application, rather than by site

To meet its pledge to achieve net zero carbon emissions by 2060, Kuwait is aiming to cut its direct gas emissions

in the oil and gas sector by 50% by 2040 and achieve carbon neutrality in that sector by 2050.

To help the country progress towards these goals, mobile operator Zain Kuwait is aiming to reduce its carbon emissions by 16.7% by 2027 compared with 2022 and then achieve net zero by 2050. To that end, it needs to reduce wireless energy consumption and carbon

emissions cost-effectively, and without harming the end user experience of its services.

The ICT (information and communications technology) sector is now responsible for 3% to 4% of global CO2 emissions, about twice the level of the much more heavily scrutinised aviation sector, according to a 2021 report by BCG. As demand for digital services and connectivity rises inexorably, the industry could be responsible for up to 14% of global CO2 emissions by 2040, unless significant steps are taken to lower the environmental impact of ICT companies.

Within the ICT industry, telecoms operators have a sizeable impact on both CO2 emissions and energy usage: they are responsible for 1.6% of total global CO2 emissions, according to BCG. To reduce carbon emissions from infrastructure and build greener networks, telcos need to reduce base station energy consumption, which accounts for a high proportion of the sector's energy consumption.

According to GSMA, the radio access network accounts for 73% of the energy consumed by mobile operators. The network core (13%), data centres (9%) and other operations (5%) account for the rest.

Solution – employing AI to dynamically optimise power consumption

On a mobile network, the traffic volume, the available energy-saving features, band and equipment energy efficiency, and the coverage of each band vary site by site. To help mobile operators cut through this complexity and optimize the power consumption of each base station, Huawei has developed an AI-based energy efficiency solution called iPowerStar.

In Kuwait, Zain has deployed iPowerStar on 96 5G sites, where the solution adjusts power consumption in line with traffic changes. It employs multiple mechanisms including symbol power adjustment (based on traffic and load), pro-active scheduling, intelligent power-off carriers in the same

coverage, intelligent radio frequency channel shut down or dynamic muting, and AAU (active antenna unit) dormancy.

The iPowerStar solution is also designed to address one of the major hurdles in optimising network energy efficiency - the high interference that occurs between cells, particularly in dense 4G/5G intra-frequency networks with inter-site distances of 500 meters or less. This interference not only degrades network performance, but also increases power consumption.

To reduce this interference, iPowerStar employs millisecond-level multi-cell coordination. When certain cells within a cluster experience heavy traffic and severe interference from neighbouring cells, iPowerStar reduces some common reference signal (CRS) symbols and user-level physical downlink control channel (PDCCH)/physical downlink shared channel (PDSCH) transmit power in specific sub-frames of neighbouring cells. This reduction in interference significantly lowers power consumption in radio frequency modules.

Traditionally, resource shutdown strategies have been employed during off-peak hours to save energy, but this approach can impact key performance indicators (KPIs) during daytime operations. By contrast, Huawei says iPowerStar's real-time resource shutdown, executed in milliseconds, has no adverse effects on KPIs. This allows for energy savings to extend from idle times to the entire day, leading to substantial energy conservation.

Within a mobile network, different regions have varying requirements and customer preferences regarding network KPIs. For instance, in regions where stringent network KPIs are demanded, cell throughput thresholds are typically established. Energy-saving solutions are enabled only when the cell throughput falls below this threshold, limiting potential energy savings.

However, iPowerStar employs a more dynamic approach by considering customer intentions and real-time energy efficiency modelling. After detecting site scenarios, such as low traffic, off-peak hours, and VIP services, the technology aims to balance energy savings and performance. During low-traffic periods, the system can reduce

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target cell throughput thresholds, enabling more energy-saving measures. In areas with VIP services, it prioritises the user experience, ensuring that VIP service requirements are met.

Zain Kuwait has also replaced traditional AAUs (active antenna units) with Huawei's Meta AAUs to further reduce the power consumption per site, while providing the same coverage and experience to the end users. The Meta AAUs employ advanced technologies, such as Massive MIMO, SDIF (signal direct injection feeding), and Multi-band RF, to significantly reduce power consumption without impacting the user experience.

Huawei says the Meta AAU can provide the same user experience and coverage with lower power consumption compared to the traditional AAU. The multi-band RRU can support all the low or mid bands within the same module, which at least halves the number of RRUs to be deployed, thus, reducing the energy consumption and overall total cost of ownership. Moreover, the latest SDIF antenna adopts new materials and designs to eliminate the feeder cable inside the antenna, thereby improving energy efficiency.

Impact – a 25% improvement in energy efficiency

Across the 96 base stations employing the iPower-Star solution, energy consumption has fallen from 5,155.07 kwh/day to 3,879.73 kwh/day, according to Huawei. That equates to an improvement of energy efficiency of 25% (assuming the traffic remains the same), which will avoid 348 tons of CO_2 emissions per year – a positive impact on the natural environment and the planet equivalent to planting more than 19,300 trees.

Meanwhile, Huawei says the Meta AAU can provide the same user experience and coverage with lower power consumption compared to the traditional AAU while improving the bit-per-watt efficiency by 15-20%. Moreover, the latest SDIF green antenna improves energy efficiency by 15%.

Wider Implications – potential for major progress towards net zero

If AI-based energy efficiency management is widely deployed by Kuwait's telecoms sector, as it rolls out 5G, the country will take significant steps towards the target of realising net zero carbon emissions by 2060. Zain Kuwait is also exploring how it can introduce energy saving solutions across its whole network, including fixed lines and the core. At the same time, the telco intends to maximise the use of renewable energies, such as solar panels and lithium batteries, to further cut carbon emissions.

Huawei forecasts that the ICT sector can achieve a 20% reduction in CO_2 emissions by 2030. "There are many other sectors where 5G and other related technologies can have a dramatic impact on sustainability," adds Nawaf Algharablly, CTO of Zain Kuwait. "Some of these are particularly important because they affect every industry. For instance, transport contributes around one-third of total emissions in many regions, so there is considerable interest in using 5G to support rising levels of vehicle autonomy, so that vehicles, powered by renewable sources of electricity, have the real-time information they need to make the best decisions about routing, parking and so on, and thus use power most efficiently and avoid traffic congestion and pollution."

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Nawaf Algharablly - CTO of Zain Kuwait

About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

For more information, please visit the GSMA corporate website at gsma.com

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About the GSMA Foundry

The GSMA Foundry is the go-to place for cross-industry collaboration and making positive change happen, supported by leading technology organisations and companies. By bringing together members and key industry players, engaging, and unifying the end-to-end connectivity ecosystem, the GSMA is solving real-world industry challenges.

Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. This enables the mobile industry's mission: to connect everyone and everything to a better future.

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About Zain Kuwait

Mobile Telecommunications Company - Zain was founded in 1983 in Kuwait as the first telecom operator in the Middle East and Africa. The Group's flagship operation has enjoyed a proud history of achievements since then, including becoming the first operator to launch a commercial GSM service in the region in 1994, as well as becoming the first company in Kuwait to launch nationwide 4G LTE Internet services in 2012. In 2019, Zain announced its network was fully ready for the commercial launch of fifth generation wireless technology (5G) to be the first operator to offer 5G in the GCC region via the Kuwaiti market with nationwide coverage of all areas.

Zain follows several strategic objectives to consistently exceed customer expectations and maintain its leadership position by offering products, services, and promotions that meet their needs and aspirations. The company is committed to offering world-class services through its digital and traditional channels, including zBot, the company's AI-based interactive chatbot, as well as its largest network of branches and dedicated 24/7 call center (107).

Zain believes the Kuwaiti private sector is a strategic partner to local developmental plans. Throughout the recent years, the company has enjoyed a distinguished track of fruitful partnerships with many government institutions and took many steady steps towards strengthening its leadership position in the local and regional ICT sector. Zain's vision centers around empowering full digital transformation in all of Kuwait's vital sectors in partnership with both the private and public sectors.

As a main partner of the community, Zain is keen on delivering its Corporate Sustainability and Social Responsibility strategy through investing in and launching several sustainable initiatives that cater to education, health, environment, youth, sports, and other essential sectors. Zain believes that it has a responsibility to lead in the promotion of positive behavioral change within the community, and will continue to find ways to inspire and motivate people in leading humanitarian initiatives so as to foster a better world for everyone.

About this case study